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APPLICATIONS OF THE 6P9 PENTODE

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The 6P9 pentode is intended chiefly for final amplification of video signals under Class A operating conditions. Three variations of its operating conditions in amplifiers for this purpose may be mentioned.

In the first case (see Figure 1,a) /Figures are appended/ a negative bias is applied to the control grid, which fixes the operating point on the curve so that the plate current, when there is no signal, is weak (5-10 ma). The signal voltage applied to the grid from the detector must have a positive polarity, i.e., the plate current must be increased.

In the second case (see Figure 1,b) the voltage on the control grid approaches zero and the signal voltage applied to the grid from the detector has a negative polarity. Consequently, when there is no signal, the plate current reaches its maximum (generally 25-60 ma) but decreases with the appearance of a signal.

In both cases, the direct coupling between the tube control grid and the load resistance of the diode detector permits the transfer, of the so-called constant (dc) voltage component to the control electrode of the cathode-ray tube.

The third method of applying video signal voltage to the control grid differs from the first two cases in that the coupling to the preceding stage is made through a capacitor which does not let the dc component pass. Consequently, the voltage at the control grid changes on both sides of the grid voltage, and the appearance of a signal or a change in its value has practically no effect on the dc component of the plate current.

Two variants of the circuit in the latter case are shown in Figure 2. Figure 2,a shows the application, to the tube grid, of a synchronizing signal voltage with negative polarity; Figure 2,b -- with positive polarity.

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The appended table give the recommended operating conditions for a 6P9 tube when used in the final video amplifier stage. Columns 1 to 3 in the table refer to the diagram in Figure 1,a and the more detailed diagram corresponding to it in Figure 3,a; columns 4 and 5 refer to Figure 1,b and the corresponding diagram in Figure 3,b; columns 6, 7, and 8 refer to diagrams in Figures 2 and 4. In the latter case, a diode is used in the picture-tube control-grid circuit to restore the dc component.

When the total capacitance is 25 μμfd (consisting of the output capacitances of the tubes, the input capacitance of the picture tube, the capacitance of assembly and of the compensation coils L_1 and L_2) and when the compensation is properly adjusted, the values 1,200, 1,800 and 2,400 ohms given in the table for the load resistance R_n will give corresponding values of 0.03, 0.045 and 0.06 μsec, respectively, as in time required for establishing a voltage in the final video amplifier stage [circuit time constant]. If this time [constant] is 0.06 μsec, at 6 Mc the amplification will be 3 db (1.4 times) less than the lf amplification, which would decrease picture quality.

To get a good picture, the time for establishing a voltage must not be over 0.05-0.06 μsec, which can be obtained by reducing this period for separate stages to 0.03 μsec. Correspondingly, the load resistance R_n must be 2,000-3,000 ohms (assuming that the shunt capacitance is 25 μμfd). Reducing the resistance R_n to 1,000-1,500 ohms will considerably improve picture quality.

The operating conditions recommended in the table are intended for an output voltage range of 50, 55 and 60 v for the following reasons. Under practical conditions, for cathode-ray tubes of types 18LK15 (LK-715A), 23LK1B and 31LK1B (30LK1B), the maximum voltage range at the control electrode required to modulate the beam current from 1 to 100 μa is 30 v. In reproducing the specially bright details of a picture, the beam current may reach 200 μa, but for the dark parts the beam current may be reduced to 0.1 μa or less.

It may be assumed that for the three types of C-R tubes mentioned, the minimum voltage range which will ensure full modulation of the beam current (from 0.1 to 200 μa) is 38-39 v. It must also be taken into account that the amplitude of the synchronizing pulses will be 42% of the maximum video signal voltage, since the full voltage range which must be applied to the space between the grid and the cathode of the tube amounts to about 55 v.

The three main variants of the 6P9 pentode's operating conditions given in the table may also be used in the final stages of video amplifiers of different design.

Operating Conditions of the 6P9 Pentode in the Final Video Amplifier Stage

	Operating Conditions							
	1	2	3	4	5	6	7	8
Load resistance in plate circuit, ohms	1,200	1,800	2,400	1,800	2,400	1,200	1,800	2,400
Plate supply, v	225	225	250	225	250	225	225	250
Screen grid supply, v	225	225	250	225	250	225	225	250
Screen grid voltage (*), v	150	108	75	108	75	150	108	75
Screen grid circuit resistance, kilohms	--	--	--	--	--	10	23	70
Control grid bias, v	--4.7	--3.4	--2.7	0	0	--	--	--
Control grid circuit resistance, megs			0,001—0.5				0.01—1.0	
Automatic bias resistance, ohms	--	--	--	--	--	53	80	94
Quiescent plate current, ma	13	8	5	39	26	36	21	14
Quiescent screen current, ma	2.5	1.5	1	11	5	8	5	2.5
Control-grid ac swing, v	4.7	3.3	2.6	3.3	2.6	4.7	3.3	2.6
AC voltage swing on load resistance, v	60	55	50	55	50	60	55	50
Required rated power of load resistance, w	2.25	1.25	0.75	3.0	2.0	1.75	1.0	0.5
Permissible limits of plate and screen grid supply, (**) v	175-300	140-300	120-300	140-290	120-300	160-275	140-300	120-300

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(*) Under conditions 1-5, the voltage at the screen grid must be rigidly fixed, for example, by stabilivolts of types SG4S (150S5-30), SG3S (105S5-30), SG2S (75S5-30).

(**) Use of a source with lower voltage than that indicated leads to appearance of distortions and, under some conditions, also to overheating of the screen grid. Use of a higher voltage than indicated shortens the life of the tube because of overheating of the plate. Changes in the screen grid supply must be accompanied by corresponding changes in the resistance in the screen-grid circuit.

/Figures follow/

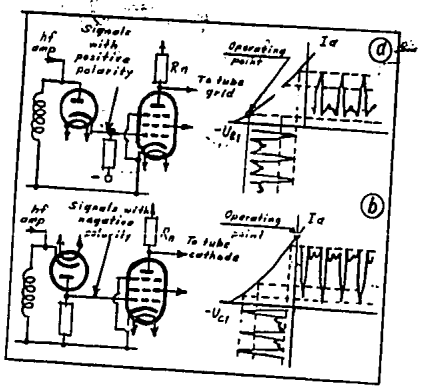

Figure 1

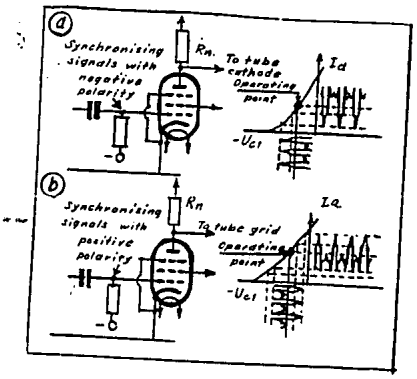

Figure 2

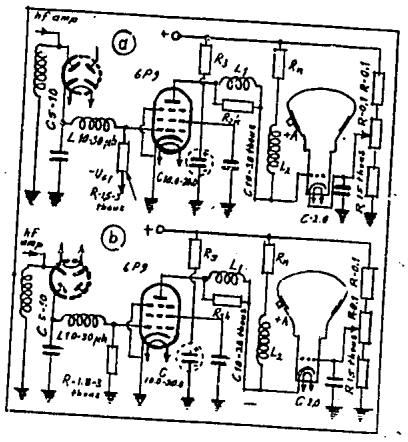

Figure 3

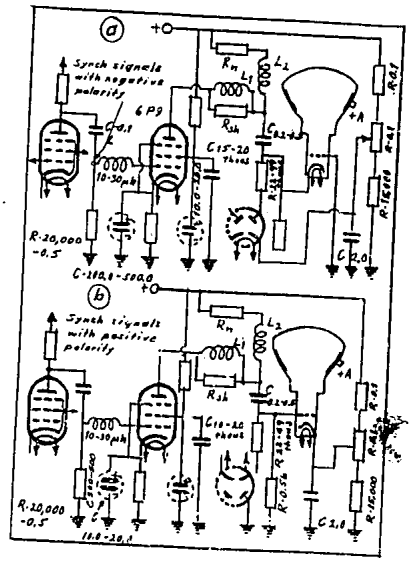

Figure 4

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